REPRINTED FROM

JOURNAL OF NATURAL SCIENCES
AND
MATHEMATICS

VOLUME XIX NO. II, OCTOBER 1979, pp. 209—222

EFFECT OF REPLACEMENT OF SUCROSE WITH LIQUID GLUCOSE ON THE KEEPING QUALITY OF GUAVA CHEESE

By

A. Rahman Chaudhry and B.A. Mahmud

A Research Council Publication
Government College, Lahore (Pakistan)

J. Nat. Sci. Math. Vol. XIX. No. II, October 1979, pp. 209—221.

EFFECT OF REPLACEMENT OF SUCROSE WITH LIQUID GLUCOSE ON THE KEEPING QUALITY OF GUAVA CHEESE

By

A. RAHMAN CHAUDHRY AND B. A. MAHMUD

Department of Chemistry, Government College, Lahore.

Abstract

Effect of replacement of sucrose by liquid glucose on the keeping quality (upto 180 days) of guava cheese was studied. Sucrose was replaced upto 40% with liquid glucose. Quantitative as well as Qualitative evaluation of the samples was carried out at 30 days interval. All the samples were organoleptically acceptable. The sample containing 40% of liquid glucose was found to have highest percentage of ascorbic acid.

INTRODUCTION

Guava (Psidium guajava L.) has been recognised as an outstanding source of vitamin C since it provides as much as 1160 mg/100 g. of ascorbic acid[1]. Guava fruit sells in market twice a year. Quite often a substantial amount of fruit remains unsold and goes as waste. The surplus fruit can be utilized in the preparation of low cost guava beverages, guava cheese ete. The products retain vitamin C to a great extent[2].

Some workers ([3-5]) have reported the preparation of guava products using only sucrose as sweetening agent. Moreover the keeping quality and quality of stored products have not been studied

Guava cheese based on sucrose contain about 80% total soluble solids, the major portion of which comes from sucrose. The sucrose based product is not relished by many consumers because of too much sweetness. Hence sucrose has been partially replaced with liquid glucose in order to maintain the level of total soluble solids and at the same time reduce the sweetness of the product to the desired level.

Liquid glucose has been utilized by many workers in the preparation of food products. The chief advantages being that it reduced the chance of sucrose crystallization[6].

In the present study 10 to 40% sucrose has been replaced by liquid glucose in the preparation of guava cheese.

MATERIALS AND METHODS

Materials : White variety of guava was purchased from the local market. Sound ripe guava fruit was sorted out, washed, hand-peeled and cut into small pieces. This was blanched with live steam for three minutes. The blanched fruit was transferred to a tomato-pulper and thick seed-free paste was made. Guava cheese was prepared according to the recipe given in Table I. Sugar was replced with liquid glucose 10 to 40% in subsequent recipes.

TABLE—I

Ingredients	Quantity (parts weights)
Pulp (seed-free paste)	100.00
Sugar	150.00
Butter Oil	27.50
Citric Acid	0.22
Table salt	0.05
Food colour (red)	—

Cheese Preparation : All ingredients except salt and citric acid were mixed and cooked until jellying point reached which was determined by sheet test[7]. Citric acid and colour dissolved in a quantity of water added to the cooked material. The cheese was poured into sterilized wide-mouth glass jars at 106-107°C. The jar was immediately capped and stored at room temperature. Samples were analysed just after preparation and at 30 days intervals upto a storage period of 180 days.

METHODS

1. **Determination of Total Soluble Solids (TSS)[8] :** The determination was carried out by Abbe Refractometer Caliberated to (% sucrose) and the results reported at Brix.

2. **Determination of Total Acidity[8] :** This was determined by titrating 10 ml. of aqueous extract with 0.1 N NaOH using phenolphthalein as indicator.

3. **pH :** This was determined by Beckman pH meter model 96.

4. **Determination of Ascorbic Acid :** The method adopted by **Barket et al[9]** was used for this determination.

5. **Organoleptic Evaluation :** Coded samples of guava cheese were presented to a panel of five judges. The judges were represented to arrange the guava cheese samples in order of preference of colour, taste, flavour and texture. The results of all the five judgements were added and termed as totat ranks.

6. **Analysis of Variance :** Analysis of Variance of all the tabulated data was carried out according to the method of Steel and Torris[10].

RESULTS AND DISCUSSION

1. Total Soluble Solids

It would appear from the results as recorded (Table II) that guava cheese containing 100% sucrose had the highest total solubls solids (81%) while the cheese having higher 40 : 60 liquid glucose/sucrose ratio has the lowest total soluble solids (79%). The difference in total soluble solids contents of various samples of guava cheese seems to be due to hygroscopic nature[11] and jellying properties of liquid glucose. Khan and Asghar[12] have reported that jellying point of jam with 100% sucrose reaches at higher temperature than 40 : 60 corn syrup and sucrose ratio. The higher the temperature the greater is the loss of moisture. Hence the degree brix was highest in case of 100% sucrose while it was the lowest with 40% liquid and 60% sucrose.

An increase in TSS contents was observed in all the samples of guava cheese during storage period upto 180 days. The increase

in TSS seems to be due to the conversion of insoluble constituents into soluble ones during storage. The analysis of variance data (Table VII) reveals a significant effect of liquid glucose and highly significant effect of storage period on the variation of TSS of guava cheese.

2. Acidity and pH

The initial total titratable acidity in all the samples was the same. However, during storage a considerable decrease in acidity was observed in all cases (Table IV). This significant effect of storage period on acidity is evident from statistical analysis of data (Table VII) which indicate very high values of F. ratio for storage period. The decrease in acidity was accompanied by an increase in pH (Table V). The decrease in acidity was comparatively less (0.67-0.36) in sucrose based samples as compared to liquid glucose (0.67-0.30). Variation in pH however, was not directly related with acidity of the produce as the pH of sucrose based cheese was higher (4.60) and that of 40% liquid glucose based cheese was lower (4.48) although the former had higher percentage (0.36%) of acidity than the later (0.30%). These changes are highly significant both from treatments (sucrose and liquid glucose) point of view as well as from that of storage period (Table III). The decrease in acidity and in turn increase in pH seems to be due to suppressive effect of invert sugar (derived from sucrose and liquid glucose) on the degradation of pectic substances into free uronic acids and on dissociation of added citric acid[4].

3. Ascorbic Acid

Ascorbic acid content of different guava cheese samples varied considerably when analysed just after preparation and during storage (Table VI). The data show that cheese samples containing higher concentrations (90-100%) of sucrose have lower (42.5 mg/100 g) ascorbic acid contents whereas the samples having higher (20-40%) concentration of liquid glucose contain higher (55.0-55.5 mg/100 g) contents of ascorbic acid. This seems to be due to the fact that higher concentration of liquid glucose lower the gellying point (gellying occurs at lower temperature) which results in lesser

loss of ascorbic acid because of shorter heating period at lower temperature.

A similar trend in losses of ascorbic acid was observed during storage upto 180 days, (Table V) shows that about 50% (decreese from 42 to 21 mg/100g) of ascorbic acid was lost by samples containing 90-100% sucrose while loss in samples containing 20-40% liquid glucose was 34%. Analysis of variance data suggest these changes to be highly significant as F. Ratio values are very high both for treatments as well as for storage periods. Degradation of ascorbic acid during storage may be attributed to the presence of anthocyanin pigments as reported by Tressler and Joslyn[12]. Guava contains significant amount of these pigments which accelerate the loss of ascorbic acid, in its products, during storage.

4. Organoleptic Evaluation

Subjective evaluation in terms of desirable guava cheese colour flavour, taste and texture were formed after 30,60,90,120,150 and 180 days storage at ambient temprature. The results of these evaluations, are reported in Table VI.

(a) **Colour** : Sample E (40% liquid glucose) ranked the highest as far as the colour of guava cheese was concerned, it was followed by samples D.C.B. and A in rank order throughout the storage period upto 180 days. It indicates that colour of sample A was the least liked. Sample C had an edge over sample D until 90 days storage but after that D was preferred over C. Therefore, replacement of sucrose upto 40% with liquid glucose had a highly sigificant (F. Ratio 44.75 Table VII) favourable effect on the acceptabiliy of guava cheese with respect to colour. Rank position of the samples increased with the increase in the concentration of liquid glucose from 10-40%. Storage upto 180 days did not affect the rank position of various samples.

(b) **Flavour** : Results of flavour analysjs showed that replacement with liquid glucose affect the flavour of the samples significantly (Table VIII) as samples A,B and C ranked first during the first 90 days and samples D and E followed these samples. During next storage period sample A maintained its position while sample B and C joined

the sample D and E in ranks. After 180 days a little change in the flavour of sample E was observed while flavour of other samples was least affected.

(c) **Taste :** The results of taste evaluations are somewhat different from the flavour values of guava cheese. However, it is obvious from the rank order of the various samples that samples containing maximum (40%) amount of liquid glucose to be the least desired product during the early days of storage period. During storage upto 180 days an improvement in the taste of the products E, D and C was observed while the taste of samples A and B deteriorated (Table VII).

(d) **Texture :** Replacement of sucrose showed adverse effect of texture at least upto 60 days storage period. However with the advancement of storage times the samples containing higher amount of liquid glucose ranked higher and during last two storage intervals sample B ranked the highest in texture values followed by samples D and C (Table VIIJ.

The non-significant variation (Table VII) between judges indicates that judges were unanimous in their opinion in most of the cheese except in evaluating the taste where it had been shown that liquid glucose had a significant effect on the taste.

REFERENCES

1. V.L.S. Charley, **Tech. Commun. 21**, 126 (1950)
2. M.K.R. Siddique, and M.A. Farooqi, **Pakistan J. Sci. Res. 11.** 29 (1950).
3. E.J. Hartzler, **Nutrition. 35**, 419 (1948).
4. W.K. Shah, N.A. Sufi, and S.I. Zarar, **Pakistan J. Sci. Ind. Res., 18**, 179 (1975).
5. N.A., Sufi, J.N. Mwale, and M.T. Kaputo, **Zambia J. Sci. Technol 1**. 126 (1976).
6. E.N. Mecker, **Food Technol. 4.** 361 (1950).
7. C.H. Rauch, "Jam Manufacture" pp. 37-39 Leonard Hill Ltd., London.
8. A.O.A.C. "Official Methods of Analysis of the Association of Official Analytical Chemists".
9. Z.N. Barkat, F.N. Wahab, and M.N. El-Sadr, **Analytical Chemistry.** 27, 536 ((1955).
10. R.D. Steel, and J.H. Torrie, "Principles and Procedures of Statistics" McGraw Hill, Torronto, London (1960).
11. M. Zimmermann, **"Revue des Fabricants de Confiserie. Chocolateric, Confitureric, Biscuiterie" 51**, 14 (1976) (FSTA 9 : 1128).
12. M.A. Khan, and A. Asghar, **Pakistan J. Agri. Sci. 11.** 25 (1974).
13. D.K. Tressler, and M.A. Joslya. Chemistry and Techno. logy of Fruit and Vegetable Production" pp. 225 (Avi. N.Y., (1954).
14. T.R. Seshadri, and K. Vasishta, **Current Sci. (India), 34.499** (1963).

TABLE—II

Effect of Replacement of Sucrose with Liquid Glucose on Total Soluble Solids (°Brix) Guava Cheese During Storage.

Sample*	Storage Period (Days)							
	0	30	60	90	120	150	180	
A	81.0	81.4	81.6	81.8	82.1	82.4	82.5	
B	81.0	81.5	81.6	81.8	82.0	82.3	82.4	
C	80.5	80.5	81.0	81.5	82.0	82.2	82.4	
D	80.0	80.5	81.0	81.4	81.8	82.0	83.3	
E	79.0	79.2	80.8	81.0	81.5	82.0	82.2	

* A : 100% Sucrose.
B : 90% Sucrose + 10% Liquid glucose.
C : 80% Sucrose + 20% Liquid glucose.
D : 70% Sucrose + 30% Liquid glucose.
E : 60% Sucrose + 40% Liquid glucose.

TABLE—III

Effect of Replacement of Sucrose with Liquid Glucose on Total Acidity (% citric acid) of Guava Cheese During Storage.

Sample*	Storage Feriod (Days)							
	0	30	60	90	120	150	180	
A	0.67	0.66	0.58	0.50	0.48	0.40	0.36	
B	0.66	0.64	0.58	0.54	0.48	0.41	0.35	
C	0.67	0.64	0.58	0.53	0.48	0.40	0.31	
D	0.67	0.64	0.58	0.51	0.48	0.40	0.30	
E	0.67	0.63	0.59	0.50	0.47	0.38	0.30	

TABLE—IV

Changes in pH during Storage of Different Samples of Guava Cheese.

Sample*	Storage Period (Days)							
	0	30	60	90	120	150	180	
A	4.30	4.40	4.50	4.55	4.56	4.58	4.50	
B	4.00	4.10	4.20	4.25	4.40	4.44	4.48	
C	4.11	4.14	4.20	4.30	4.41	4.45	4.45	
D	4.12	4.15	4.21	4.31	4.42	4.46	4.47	
E	4.12	4.16	4.22	4.33	4.44	4.48	4.48	

TABLE—V

Effect of Replacement of Sucrose with Liquid Glucose on Ascorbic Acid contents (mg/100 g.) of Guava cheese During Storage.

Sample*	Storage Period (Days)							
	0	30	60	90	120	150	180	
A	42.5	40.0	36.6	32.4	29.0	25.0	21.0	
B	42.8	40.1	37.0	33.1	29.0	26.1	21.8	
C	55.0	53.5	51.3	47.5	43.2	40.1	36.7	
D	55.1	53.0	52.1	48.0	44.1	41.3	38.0	
E	55.5	53.8	51.1	48.8	44.3	41.6	38.5	

TABLE—VI

Organoleptic Evaluation of Guava Cheese Stored at Ambient Temperature for 180 days

Quality Parameters	Storage Period (Days)																	
	30			60			90			120			150			180		
	Samples*	Mean Rank**	Rank Order	Samples*	Mean Rank**	Rank Order	Samples*	Mean Rank**	Rank Order	Samples*	Mean Rank**	Rank Order	Samples*	Mean Rank**	Rank Order	Sample*	Mean Rank**	Rank Order
Colour	A	5.0	4	A	4.8	4	A	3.4	3	A	3.4	3	A	3.4	4	A	3.4	4
	B	4.0	3	B	3.6	3	B	3.4	3	B	3.4	4	B	3.6	5	B	3.8	5
	C	2.4	2	C	2.4	2	C	2.8	2	C	3.0	3	C	3.0	3	C	3.2	3
	D	2.4	2	D	2.4	2	D	2.8	2	D	2.8	2	D	2.8	2	D	2.8	2
	E	1.2	1	E	1.8	1	E	2.6	1	E	2.4	1	E	2.2	1	E	1.8	1
Flavour	A	1.8	1	A	1.8	1	A	2.6	1	A	2.8	2	A	1.8	1	A	2.2	1
	B	1.8	1	B	1.8	1	B	2.6	1	B	2.6	1	B	3.0	2	B	2.8	2
	C	1.8	1	C	3.4	2	C	2.6	1	C	2.8	2	C	3.0	2	C	2.8	2
	D	2.2	2	D	3.4	2	D	3.0	2	D	2.8	2	D	3.0	2	D	2.8	2
	E	4.2	2	E	3.4	2	E	3.0	2	E	2.8	2	E	3.0	2	E	3.2	3
Taste	A	1.8	2	A	1.8	1	A	2.4	2	A	3.0	2	A	3.2	2	A	3.4	2
	B	1.6	1	B	1.8	2	B	2.4	2	B	2.4	1	B	3.2	2	B	2.4	1
	C	3.4	3	C	3.4	3	C	1.6	1	C	2.4	1	C	2.2	1	C	2.4	1
	D	3.4	3	D	3.4	3	D	3.8	3	D	3.0	2	D	3.2	2	D	2.4	1
	E	4.2	4	E	4.2	4	E	4.4	4	E	4.2	3	E	3.2	2	E	2.4	1
Texture	A	2.6	1	A	2.4	1	A	2.2	2	A	3.8	3	A	4.2	4	A	4.0	4
	B	2.8	2	B	2.8	2	B	2.0	1	B	3.8	3	B	4.0	3	B	4.0	4
	C	2.8	2	C	2.8	2	C	3.0	2	C	2.2	1	C	2.6	2	C	3.2	3
	D	2.8	2	D	2.8	2	D	3.0	2	D	2.6	2	D	2.6	2	D	2.0	2
	E	4.0	3	E	4.2	3	E	4.2	3	E	2.6	2	E	1.6	1	E	1.8	1

** Average of 5 Judgements.

TABLE—VII

Analysis of Variance (ANOVA) For Total Soluble Solids, Acidity, pH, Ascorbic Acid and Organoleptic Evaluation

ANOVA FOR		Source of Variation	DF	SS	MS	F. Ratio
Total Soluble Solids		Trestments	4	4.87	1.22	11.07**
		Periods	6	18.10	3.01	27.36***
		Error	24	2.73	0.11	
		Total	34	25.70		
Acidity		Trestments	4	0.0014	0.00035	1.94*
		Periods	6	0.4779	0.07965	442.5***
		Error	24	0.0044	0.00018	
		Total	34	0.4837		
pH		Trestments	4	0.2381	0.0595	60.00***
		Periods	6	0.6391	0.1065	110.00***
		Error	24	0.0228	0.0010	
		Total	34	0.9000		
Ascorbic Acid		Treatments	4	1811.78	429.94	871.03***
		Periods	6	1502.54	250.36	481.96***
		Error	24	12.54	0.520	
		Total	34	3326.52		
ORGANOLEPTIC EVALUATION	COLOUR	Treatments	4	35.80	8.95	44.75***
		Judges	4	2.97	0.74	3.70*
		Error	21	4.20	.20	
		Total	29	42.97		
	FLAVOUR	Treatments	4	4.33	1.08	8.31**
		Judges	4	1.47	0.37	2.84*
		Error	21	2.87	0.13	
		Total	29	8.67		
	TASTE	Treatments	4	15.86	3.96	18.85**
		Judges	4	6.33	1.58	7.52**
		Error	21	4.51	0.21	
		Total	29	26.70		
	TEXTURE	Treatments	4	1.53	0.38	0.41*
		Judges	4	2.57	0.64	0.69*
		Error	21	19.27	0.92	
		Total	29	23.37		

* Non-significent at 5% Level ** Significent at 5% Level *** Highly significant at 5% Level